

## **Building a City: Local Adaptations of Construction-related Technologies and Practices in Roman Imperial Sagalassos (SW Asia Minor)**

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The archaeological site of Sagalassos (SW Turkey) is mainly the result of organised community formation between Late-Achaemenid to Middle Byzantine times (5<sup>th</sup>-3<sup>rd</sup> c. BCE to 11<sup>th</sup>-13<sup>th</sup> c. CE). The settlement's heyday as a regional urban centre came during the Roman Imperial period (1<sup>st</sup>-3<sup>rd</sup> c. CE). During this time period, the cityscape was gradually monumentalised through the initiatives and efforts of the local elite, the city council, the popular assembly and many others. At the onset (late 1<sup>st</sup> c. BCE-1<sup>st</sup> c. CE), this building craze required local actors to adapt pre-existing local and innovative technological and logistical construction-related practices. A variety of major and minor construction-related innovations, which had originally emerged elsewhere within the empire or even in a distant past, were now adapted for local use in a rather modest mountain city. Extensive excavations around the city's Upper Agora, which was constructed in Early Roman Imperial times, and in other locations have provided extensive datasets – including stratigraphic information – regarding construction-related technologies and the use of building materials, some of which have been analysed through interdisciplinary techniques. The fact that part of the site has been expertly restored, has provided additional insights in building-related details, which came to light during the anastylosis-process.

Sagalassos is rather unlikely to have facilitated a construction-related invention that subsequently became dispersed over a larger area. However, it was the locus of mostly minor innovations that via multifarious trajectories came into its orbit. Here, the intent to innovate is conceptualised not as some human prerogative, but as an unexpected social becoming out of pre-existing sets of actors, from which new practices emerged. If such an innovation becomes widespread in a local context or remains more or less a one-off depends on its competition with past phenomena – including the latter's applicability in new situations – and its intended and unintended consequences, both in the short and long term. The aim of this paper is not to identify ground-breaking inventions or document the spread of innovations into hitherto unknown regions, but to examine how local groups adapted both existing and – to them – unknown practices in what was an at times rapidly changing building industry. As such, we want to know when an innovative construction practice appeared in Sagalassos, interpret its intended and unintended consequences, discuss how long it might have been considered something novel *vis-à-vis* a customary practice, and when and why it disappeared.

To be able to achieve this and chronologically evaluate the use of building-related technologies, a GIS-environment has been created in which walls and other structural elements have been abstracted as polygons with chronological (mainly based on the pottery assemblages of associated foundation fills) and technological attributes (e.g construction technique, type of mortar). The results will be visualised in a series of maps, on which the subsequent interpretations and discussions will be based. Finally, the results will be placed within the wider context of Roman Asia Minor.

**Ill-Conceived, Practical, or Something Else?:  
Anchoring the Technologies of Sewers and Toilets  
in a Value System of First Century Roman Italy**

**Professor Ann Olga Koloski-Ostrow, Brandeis University**

Can we understand the development of any ancient Roman technology—its acceptance, growth, and spread within a society, that is, the anchoring of that technology—without understanding the underlying value system that might have generated its development or inspired its transformation over time? This paper considers the technologies of sewers and toilets in a few well-preserved Roman cities (Rome, Pompeii, Herculaneum, and Ostia) of the first and second centuries BCE through the lens of the Roman value system for “cleanliness” and “sanitation”.

After I establish, with literary and archaeological evidence, what that Roman value system was, on the one hand, I argue that because sewers and toilets have been so tightly tied to urban sanitation and sanitary engineering in the contemporary Western world—that is, sewers for the removal from urban landscapes of human waste and other rotting garbage, and toilets (public and private) for the removal of urine and excrement from living spaces—it is clear that modern archaeologists, often without critical evaluation, assume that Roman sewers and toilets were also “sanitary” structures just like our own, and that the technologies that kept them functioning were for precisely our same goals.

On the other hand, I show that the great sewer of Rome, the Cloaca Maxima, was not built with much attention to sanitary engineering, that many public latrines and private house toilets in Roman cities did not empty into the sewers at all (cesspits were definitely preferred in some cities, even those that did have reasonably good sewer systems), and that archaeological evidence (for example, hardened muck and sludge found inside sewers of Herculaneum, among other places) proves that urban sewer systems provided minimal overall sanitary benefits to the cities they served. The fact that Pliny the Elder (*HN*, Book 28) lists dozens, if not hundreds, of practical medicinal and cosmetic uses for excrement and urine of humans of all ages and for every type of animal (rabbit, cow, goat, pig, to name a few) strongly suggests that the Romans had a very different relationship, namely an economic one, to these forms of waste, and a keen sense of them as profitable commodities. So, we must at least consider some different motivations for the technologies of sewers and toilets and some new rationales for their design and placement, which might be quite contrary to modern concepts and to our own value systems. In this way, we may be able to see better why these technologies transformed and even died out in later periods. (They re-emerged with renewed urgency in much later periods, after the development of germ theory, for example.)

By investigating what “cleanliness” and “sanitation” might have meant to the Romans, we can better understand the technologies of sewers and toilets. I must stress that I am not seeking to undermine the great technological accomplishments of the Romans, but rather striving to go beyond easy assumptions to probe perhaps a darker (to us) reality for these technologies in Roman daily life.

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## **Abstract Anchoring Innovation: ANCHORING TECHNOLOGY IN GRECO-ROMAN ANTIQUITY**

The old and the new in the construction of the 'Parthenon'  
Janric van Rookhuijzen

Religion can be perceived as a domain of conservative forces that seek to emphasize the antiquity of cult and other traditions. Not so, however, in the case of the so-called 'Parthenon', the great temple of Athena on the Acropolis of Athens: on the evidence of its overall unprecedented design, architectural refinements, and lavish sculptural program, the temple's technological innovation is believed to be its hallmark — appropriately for the Classical period in Athens, when great advances in science, the visual arts, and literature were achieved. Here, I wish to review the innovative power of the Parthenon's architecture, and its anchoring, in the light of new discoveries regarding the temples that stand and stood on the Acropolis.

The Parthenon's innovation, along with its anchoring, is often expressed in relation to the characteristics of the temple's predecessor, the so-called 'Older Parthenon' of 490 BCE destroyed by the Persians in 480 BCE. For example, the older temple's plan of 6x16 was increased to 8x17 in the new temple, but blocks of the older temple were recycled in the newer building (Hill 1912; Korres 1997). However, according to a recent theory, the Older Parthenon may, after all, not have existed, as the assignment of material remains to the hypothetical project is highly problematic (van Rookhuijzen 2017; cf. Steskal 2004). If there was no Older Parthenon, where does this leave the purported innovation in the construction of the newer Parthenon?

New insights into the architectural history and ancient terminology of the Parthenon's neighbor, the Karyatid Temple (incorrectly known as the Erechtheion), are also emerging (van Rookhuijzen 2020). This, and no other building, was known from the moment it was built (mid-fifth century BCE) to at least the second century CE as Athena's *Archaïos Neos* (Old Temple). This fact has long puzzled scholars. How could the obviously new, beautiful temple of Pentelic marble have been called 'old' right from the start? The answer, it now seems, is that the walls of the building that we see today encased a truly old shrine (Goette 2016; Meyer 2017; van Rookhuijzen 2020). The Karyatid Temple was seen, at the time of its construction, as a renovation of the older building, and therefore worthy to be called the 'Old Temple'.

I argue that these new theories allow us to view the Parthenon's 'statement of innovation' as even greater than previously believed. It replaced not the Older Parthenon, but a different, truly old-fashioned archaic temple. In addition, it stood alongside (and therefore contrasted with) the Karyatid Temple, referred to as the 'Old Temple'. If the Parthenon was the innovative 'new temple', this prompts another question: how was all this innovation anchored? I seek the anchoring not in subtle references to the past in the temple's architecture, but rather in the powerful narratives told by its sculptural program: the pediments, metopes, frieze, and cult statue.

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Anchoring Technology

**Failed innovation or tradition done right? The case of the Treasury of the Thebans at Delphi**

Some years after the devastating earthquake of 373 BC and following their victory at Leuktra, the Thebans erected a treasury at Delphi, the first of its kind in the sanctuary of Apollo in more than a century. The location, orientation and design of the building are unusual. Perhaps the most puzzling aspect of the treasury is a much discussed technical feature of the foundation levels: a channel-like groove running on the bedding surfaces of the blocks of the two upper courses. This feature is believed to have served to anchor the building to its foundations. No other example of such technique is known, either before or after the time of the construction of the treasury. I argue that it is probably not so much a case of failed innovation as the result of a building tradition, and that both are not necessarily exclusive. Beyond this specific case study, the paper discusses the issue of determining what can be considered an innovation in the absence of textual sources.

Jean Vanden Broeck-Parant

## Hedging against failure: experiment, prototypes, and simulation in Roman technology

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The frontiers of innovation are clouded with the prospect of failure. Technological failures appear rarely in the Roman record, but when they do, they are vivid. The scandalous collapse of a wooden amphitheater at Fidenae, killing tens of thousands, tops the list (Tac. *Ann.* 4.62-63; Suet. *Tib.* 40). The initial failure of Claudius' drainage of the Fucine Lake before an expectant audience embarrassed the emperor, prompting a restaging of the event (Suet. *Claud.* 20; Dio 61.33.5). In Mauretania, tunneling for an Antonine-era aqueduct went awry, requiring its chief engineer's recall (*CIL* 8.2728). In the latter two cases, corrections were possible and the projects were completed successfully, though presumably with massive cost overruns.

The stakes of advancement are higher in some technologies than in others, and it bears considering how such considerations shape their professional practice. Testing prototypes, running trials, and training for complex new procedures are second nature in the modern world, where venture capital, regulation, legal jeopardy, and market competition raise the stakes of success or failure. But how much, and to what ends, did ancient innovators do the same? In many fields of ancient technology, evidence for simulations (I use this blanket term for my central concept) is often subtle or even nonexistent. In some, such as textile production, there seems little need for it; here the stakes of failure were low and innovation and experimentation need not have taken place in parallel with conventional production. Others, such as aquaculture, demonstrate significant investment and sponsored experimentation, research, and development. In others still, notably construction, the evidence for plans, templates, and models is robust, but the application of models that advanced to a level one might call diagnostic or heuristic—e.g., “test-drivable” prototypes such as Brunelleschi's scaled-down experimental dome assisting with construction of the cathedral of Florence—is mostly hypothetical.

This paper explores the cognitive, cultural, and philosophical underpinnings governing technological fields in antiquity as they relate to modeling. To what extent were practical simulations even plausible? In Greco-Roman medicine, they could be adopted for certain applications, such as surgery practice or dissection (e.g., on animals or cadavers), but not for others: sickness could not be simulated any more than healing. Second, to what extent could simulation be built into the final product? Aqueducts had to be self-regulating, and systems relying on equilibrium such as siphons or relieving tanks could—to a limited extent—serve as their own simulators. Third, to what extent were simulations *desired*? Did professional self-presentation, manifested in confident mastery of familiar methods, materials, and apparatus, discourage their use? Not for the physician Galen, who adopted the knowing and confrontational persona of a litigator while dissecting apes before audiences. An important strain of professionalization in this case, and probably in others, came through analogy with *controversiae* and *suasoriae*, artificial speeches designed to elucidate methods of argument and points of law. A core strategy of this project therefore involves observing how the intellectualization of trades and professions intersected with their advancement.



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*Divine Agency, Technical Knowledge, and Legitimacy of Wisdom:  
Enquiry into the Automata and the Possible Reasons for their Failure.*

‘La stagnation technique chez les Grecs va de pair avec l’absence d’une pensée technique véritable’. With these words the French anthropologist Jean-Pierre Vernant at the end of the 50s highlighted the paradox of a society that had elaborated an advanced logical-mathematical thought which did not find application in the innovation and development of new technologies. Among the motivations found by Vernant (1957) there would be the philosophical speculation of Aristotelian tradition that identified in the final cause the essential principle of a technical work and therefore devalued technical and artisan knowledge as a mere procedure of passive application of logical-mathematical principles.

The present paper aims to investigate a very particular category of technological innovations that the Greeks called *automata*, that is self-propelled artefacts. Some recent studies (Dunand 2018; Mayor 2018) have turned their attention to the analysis of narrative elaborations (from the mythical tale to the historiographical account) on the theme of statues or marvellous and self-propelled objects, but scarce attention has been given to the treatises that have exposed the processes of elaboration and construction of these objects, such as the treatises of Hero of Alexandria (Περὶ αὐτομάτων) or Athenaeus Mechanicus.

Starting from the example of the dove of Archytas, the first *automaton* of which ancient sources inform us, our study will try to understand what was the scope of application of these self-propelled machines and in which contexts they were used. Reading the text of Hero of Alexandria it is clear that the indications for the design and construction of these objects were mainly aimed at cult centres and sacred places where such statuettes, *zoidia*, could come alive, most probably during cultic actions. Is this a single case or was the scope of such machines limited to religious activities? In this case, then, would it be possible to trace in the need to keep the mechanical realization of the divine agency secret the main cause of a lack of diffusion of such objects and their construction techniques?

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